APPENDIX F

This section on the ecological impacts of stream barriers and barrier removal was written by Jesse S. Sayles and Erony Whyte from the NYS DEC Hudson River Estuary Program. The Hudson River Estuary Action Plan of 2001 strives to promote local community stewardship of estuary tributaries and stream barriers impede the full function and flow of these tributaries. There are two types of dams: run-of-the-river and impounding (Poff and Hart, 2002). Run-of-the-river dams store little or no water with short residence times (period of time water is stored) and little or no control over water release rate. Impounding or storage dams are taller, with a larger storage volume, long residence times and controlled release rates. Other stream barriers include culverts and buried streams. Culverts are enclosed pipes through which stream flow is directed. Buried streams are those that have been paved or developed over, but stream interactions with soils may still exist.

Stream barriers cause a lot of negative effects on the ecology of the river and floodplain system. I will explain these effects in general and then in terms of location: upstream of the dam, within the impoundment, downstream of the dam and in the floodplain. In general, the movement of anadromous fish, riparian species and plant seeds is restricted. Nutrients often do not get downstream of the dam nor into the floodplain which results in a decrease in biodiversity and invasive or non-native species may take over. In addition, the natural meandering of streams is also eliminated. Upstream of the dam, the flow rate of the stream decreases. Within the impoundment, the water is either slow or still which causes sediment to smother habitat and a stratification in temperature (warm on top, cool below) and dissolved oxygen (high on top, low below). Detritus, or decaying organic matter, is also trapped behind the dam which prevents nutrients and habitat for detritivores, a vital part of the food web, from reaching beyond the dam.

Downstream of the dam, the flow rate varies depending on the type of dam and the rate at which the water is released through the dam. The temperature of the water also varies according to where the water is released from the dam: flowing over the top or through a pipe in the bottom of the dam. As a result of the decreased or variable flow rate and the changes in temperature, the wildlife and plants downstream cannot adapt very well and many cannot survive which leads to a decrease in biodiversity. There is increased erosion of the stream bottom (benthos) and banks which causes loss of habitat. With a lack of detritus that provides nutrients, it is difficult for the typical stream species to survive. Finally, there is a reduction in flooding which is beneficial for human settlement, but prevents species in the floodplain from receiving the moisture levels and nutrients needed to thrive. Culverts and buried streams, depending on their length, exhibit varying degrees of these impacts. In addition, there are no floodplain interactions, limited or no sunlight and limited or no oxygen and nutrient exchange.

The decision to remove a stream barrier must take into account the short and long term ecological effects. The short-term impacts are generally negative while the long-term impacts are positive overall. For example, sediment that has been stored behind the dam will scour out habitats below the dam and it may be contaminated with toxic materials. If the sediment is contaminated, it must be dredged and moved properly. Economic, legal, safety, recreational, historic and aesthetic concerns must also be taken into account for barrier removal. Sometimes, addressing other watershed concerns first, such as pollution, will create more benefits than barrier removal. It is important to look at the barrier as a site-specific project, its context within the watershed and the cumulative

effects of several dams in the river. Some successful dam removals include the Edwards Dam on the Kennebec River in Maine and a dam on the Baraboo River in Wisconsin. Some unsuccessful dam removals include the Fort Edwards Dam on the Hudson River in New York which discharged PCB laden sediments downstream, and a dam on the Kettle River in Minnesota which killed mussels downstream, but restored fish access upstream. Monitoring and research must occur before and after removal occurs for success.